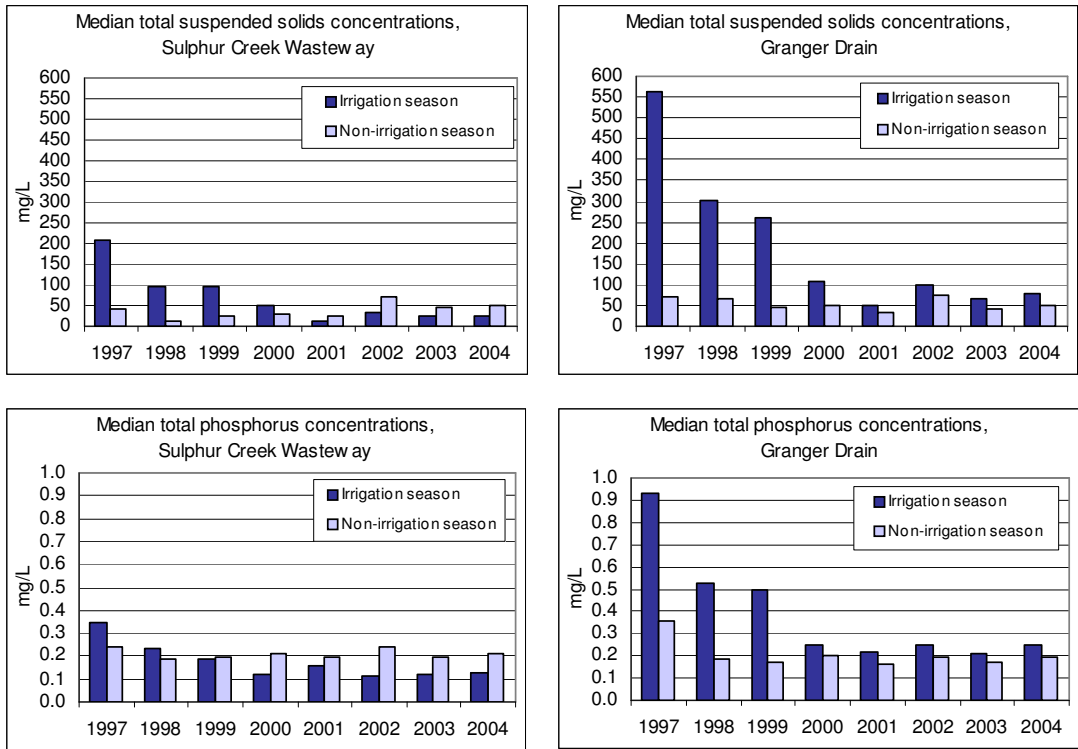


Irrigation versus non-irrigation season concentrations

In recent years in Sulphur Creek Wasteway, irrigation season concentrations of suspended sediment, phosphorus, organic nitrogen+ammonia, and nitrate were **less than** the non-irrigation season, while fecal coliform concentrations were comparable between seasons. Because Sulphur Creek Wasteway received canal water (operation spills) during the irrigation season during these years which diluted the drain water, results from irrigation return drains coming into Sulphur Creek Wasteway were also considered. These smaller drains did not receive major operational spill water from the canals. The patterns of irrigation season and non-irrigation season concentrations were similar in these drains to the patterns in the wasteway.

In recent years in Granger Drain, irrigation season concentrations of suspended sediment, phosphorus, and organic nitrogen+ammonia were similar to non-irrigation season concentrations, while remaining higher during the irrigation season for fecal coliform. As in Sulphur Creek Wasteway, nitrate concentrations in Granger Drain were lower during the irrigation seasons.



During the non-irrigation season, constituents enter into or move within the drains through some mechanism other than irrigation run-off, for example through storm water, groundwater, or bed-load movement. The influence of these other transport processes during the irrigation season is unknown but needs to be considered in future attempts to improve water quality in these drains.

Conclusion

Despite tremendous improvements in water quality, Sulphur Creek Wasteway and Granger Drain remain two of the largest sources of suspended sediment, nutrients and bacteria to the lower Yakima River. The slowing rate of improvement combined with continued non-attainment of the TMDL goal for turbidity in Granger Drain, continued violation of state standards for fecal coliform in both drains, and continued significance of nutrients discharged from these drains into the Yakima River raise many difficult questions for future consideration.

For more information, contact the South Yakima Conservation District (509) 837-7911 or the Roza-Sunnyside Board of Joint Control at (509) 837-6980.

draft

Water Quality in Sulphur Creek Wasteway and Granger Drain Watersheds, 1997 to 2004:

Considerations for Future Conservation Efforts



May 2006



Sulphur Creek Wasteway and Granger Drain are two of the most important irrigation return drains to the Yakima River due to their relative contribution of suspended sediment, nutrients, and bacteria. Tremendous improvements in water quality in these drains occurred in the late 1990's. Have the improvements continued through 2004, the most recently available data from the Roza-Sunnyside Board of Joint Control?

Highlights

Downward trends in concentrations of suspended sediment, phosphorus, organic nitrogen+ammonia, and fecal coliform bacteria in Granger Drain and Sulphur Creek Wasteway during the eight irrigation seasons from 1997 to 2004 were statistically significant. However, there were key differences between the first four irrigation seasons, from 1997 to 2000, and the last four seasons, from 2000 to 2004:

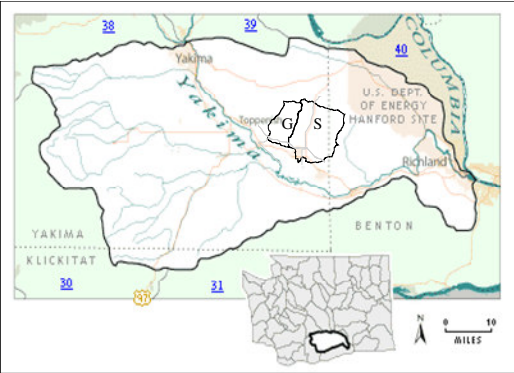
- * The rates of decline in concentrations, loads, and yields of most constituents were slower from 2000 to 2004 than from 1997 to 2000.
- * Declines were less consistent from 2000 to 2004 than during previous years. In some sub-basins, concentrations of some constituents increased. In contrast, from 1997 to 2000 concentrations of all constituents declined in all sub-basins, except nitrate in one Granger sub-basin.
- * From 1997 to 2000 the ranges of concentrations of most constituents narrowed substantially. From 2000 to 2004, the ranges of concentrations generally stabilized or only narrowed slightly.
- * From 1997 to 2000 the irrigation season concentrations of suspended sediment, phosphorus, and fecal coliform bacteria were generally much higher than the non-irrigation season in both drains. Since 2000:
 - In Sulphur Creek Wasteway, irrigation season concentrations of suspended sediment and phosphorus were **less than** non-irrigation season concentrations, while fecal coliform concentrations were comparable between seasons.
 - In Granger Drain, irrigation season concentrations of suspended sediment and fecal coliform concentrations were higher than the non-irrigation season but with a smaller gap than before 2000; phosphorus concentrations were comparable between seasons.

The Total Maximum Daily Load turbidity goal of 25 NTU was met in Sulphur Creek Wasteway from 2000 to 2004 but not met in Granger Drain in any year.

The combination of slower rates of improvement in some sub-basins, worsening conditions in other sub-basins, and slight or no decreases in the range of concentrations of most constituents during recent years suggests further improvements in water quality in these drains will be even more difficult to achieve than in the past.

Introduction

Sulphur Creek Wasteway and Granger Drain are two major irrigation return drains entering the Yakima River in south-central Washington in the semi-arid and intensively farmed lower Yakima Valley. Because water in the lower Yakima River during the summer consists largely of irrigation return flows, the water quality of irrigation return drains has a significant impact on the water quality of the Yakima River.



Location of Granger (G) and Sulphur (S) watersheds.

The declines in concentrations, loads and yields of suspended sediment, nutrients, and bacteria in these watersheds during the late 1990’s were a major success story at local, state, and national levels. Have the improvements continued?

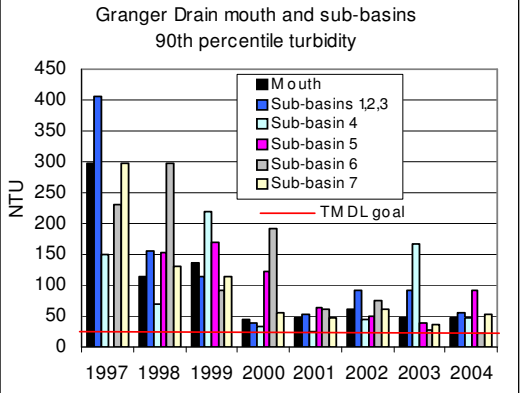
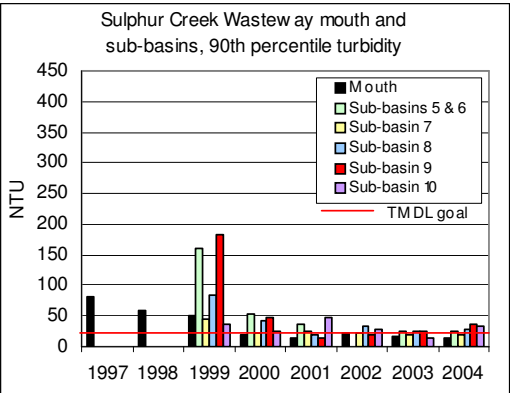
What Did We Learn?

Water quality trends from 1997 to 2004

Downward trends were statistically significant using the seasonal Kendall trend test, $p < 0.01$, for concentrations of total suspended solids (a measurement of suspended sediment), total phosphorus, total Kjeldahl nitrogen (organic nitrogen+ammonia), and fecal coliform in both drains from 1997 to 2004, except total Kjeldahl nitrogen in Sulphur Creek Wasteway was significant at $p = 0.02$. Nitrate decreases were not significant.

Total Maximum Daily Load (TMDL) progress

The mouth of Sulphur Creek Wasteway met the 2002 TMDL goal of 25 NTU at the 90th percentile from the 2000 to 2004 irrigation seasons. The 2007 TMDL goal of 25 NTU in the sub-drains was met by two Sulphur sub-basins in 2000, three sub-basins in 2001, 2002, and 2004, and all monitored sub-basins in 2003. The mouth of Granger Drain continued to not meet the 2002 goal.



Effect of drought

The amount of water available for irrigation from 1997 to 2004 was fairly constant except for the 2001 drought. During 2001, the Roza Irrigation District, a junior water right holder, received only 37% of its normal water supply. The Sunnyside Division, a senior water right holder, received 85% of its normal water supply. In the remaining years, the amount of water supply available for both districts ranged from 92 to 100 percent. The effect of the drought on water quality was seen in reduced loads of several constituents during 2001.

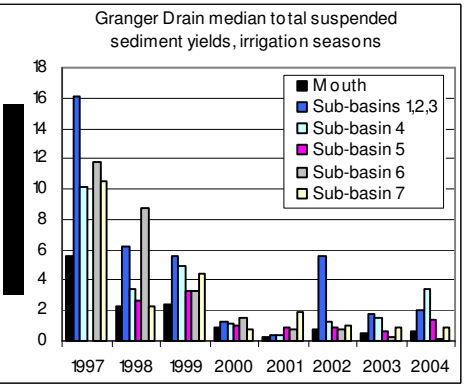
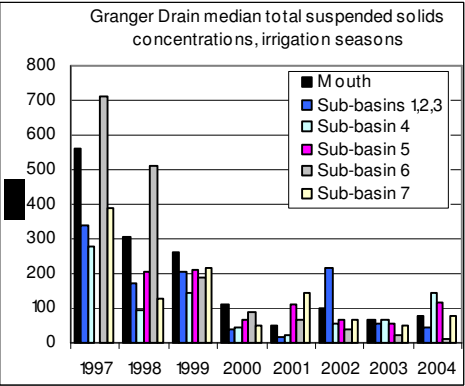
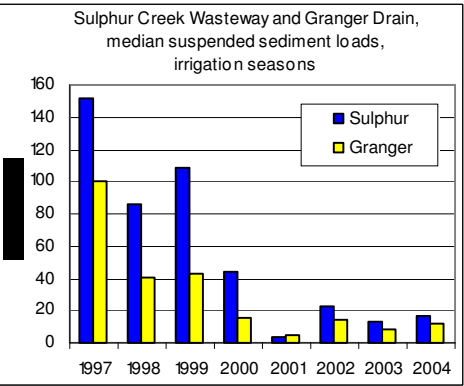
Slowing rate of improvement

Concentrations, loads, and yields of most constituents reduced less from 2000 to 2004 than from 1997 to 2000, as seen in the summary table of percent declines and charts of suspended sediment, below.

Granger Drain	Turbidity	Total Suspended Solids	Total Phosphorus	Nitrate + Nitrite	Organic Nitrogen + Ammonia	Fecal Coliform	Discharge
Median concentrations or values							
% decrease 1997 to 2000	77	81	73	12	69	48	7
% decrease 2000 to 2004	23	29	2	-3	-19	56	13
Median loads and yields							
% decrease 1997 to 2000	n/a	84	79	17	67	52	7
% decrease 2000 to 2004	n/a	27	-4	10	-7	59	13

Sulphur Creek Wasteway	Turbidity	Total Suspended Solids	Total Phosphorus	Nitrate + Nitrite	Organic Nitrogen + Ammonia	Fecal Coliform	Discharge
Median concentrations or values							
% decrease 1997 to 2000	75	77	65	35	54	73	-16
% decrease 2000 to 2004	23	49	-7	-60	-27	17	39
Median loads and yields							
% decrease 1997 to 2000	n/a	71	57	29	71	35	-16
% decrease 2000 to 2004	n/a	62	29	5	44	33	39

Negative numbers in the table above indicate increased concentrations.



Decreasing range of concentrations

The range of concentrations of most constituents decreased, especially in Granger Drain, a likely reflection of less frequent occurrences of concentrated run-off entering the drains. For an example of the decreasing range of concentrations, the left-most chart below shows the individual values for the 1997 irrigation season total suspended solids (TSS) concentrations summarized in the box plot in the center chart, while the right-most chart shows the values in the 2004 box plot. While the decreasing variability is a strong indication of the success of conservation efforts, it also indicates less room for future improvements using the same kind of conservation efforts as currently being practiced.

